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Abstract

FUEL ELEMENTS IN THE FORM OF CONCENTRIC CYLINDRICAL PLATES

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Research reactor fuel elements, containing enriched uranium, in the form of concentric cylindrical plates or tubes and cooled by water, as in the BR2 reactor at Mol, offer a wide range of possibilities for their adaptation to enable them to satisfy the diverse requirements for in-pile irradiation facilities.

This paper examines this type of fuel element from the point of view of the problems of manufacture, the test and commissioning programme of the fuel element and gives a description of the instrumentation used on in-pile tests on the different variations of the basic element; a description of the fuel element developed for the ESSOR (Euratom) reactor is given.

Details of the fabrication of this type of fuel element have already been described. Strict control is necessary during manufacture to guarantee the best possible distribution and homogeneity of the U^{235} and a complete bond between the fuel and its cladding.

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A fuel element similar to the BR2 one is proposed for the ESSOR reactor. The characteristics are given and the fabrication procedure is described.

Prototype non-fissile models of the fuel elements were submitted tc hydraulic flow tests in a water loop; temperature gradients were not created in the plates. These particular studies were concentrated on water velocity measurements; a particular point of interest is the hydraulic gauge specially developed for this work.

Results are given for the group of prototypes tested; a description of the test set-up is given in an appendix. Neutron measurements are made with the actual elements in the zero energy model of the reactor. These measurements enable the determination of a series of characteristics for a group of elements or for a particular element and to obtain the fine flux distribution inside the element.

To obtain sufficient information concerning the performance of the fuel elements in-pile a special instrumentation was developed; temperature probes to obtain the heat balance in a reactor channel occupied by a fuel element and thermocouples fixed to the plates of the elements to verify the temperatures obtained by calculation. Description is given of the other tests which show the influence of certain operational parameters.

The fuel elements have been operated at a thermal flux of 600 watts/cm^2 and the paper concludes with an attempt to determine the limiting factors of this type of element.